REMARKS/ARGUMENTS

Reconsideration of this application is requested. The Official Action and the citations raised by the Examiner have been carefully considered. Claims 1-4, 6, 7, 10, 14, 16, 20-23, 25, 26, 29, 33, 35, 39, 40, 44, 45, 51, 54-56, 60, 62 and 66 were pending in this application at the time of the Office Action dated December 27, 2007. In their June 30, 2008 response, Applicants cancelled claims 1-50 and amended the remaining claims which the Examiner had indicated were allowable. In this response, Applicants have cancelled all the claims of the application and added new claims 73-91 which correspond to claims 1, 4, 6, 7, 10, 14, 20, 23, 25, 26, 29, 33, 44, 45, 51, 54, 60, 62 and 66 respectively. Attached hereto, for the Examiner's convenience are the original claims as amended.

The pending claims recite, *inter alia*, detection of electromagnetic fields, support for which can be found throughout the specification. Further, the amendments alter "controllably altering a position…" to read "angularly displacing…", support for which can be found at least at page 15, line 9 and throughout the specification in discussion of piecewise and continuous rotation.

The claims also recite, *inter alia*, the provision of three axial gradiometers, support for which can be found at least in originally filed claim 39, and in claims 19 and 38 prior to the Preliminary Amendment which Applicants filed concurrently with the application. The three gradiometers are angularly displaced about axes which are not parallel, support for which can be found at least in claim 40 as originally filed. Still further, the claims recite that gradient tensor components and field components be determined from output signals of the three gradiometers, support for which can be found at least in claim 16 as originally filed.

Pursuant to the foregoing discussion, Applicants submit that the pending claims do not contain any new matter. Amendment to or deletion of a claim is not to be construed as a dedication to the public of any subject matter.

Claim Rejections Under 35 U.S.C. § 102

On page 2 of the Office Action, the Examiner rejected claims 1-4, 6-7, 10, 14, 16, 20-23, 25-26, 29, 33, 35, 39-40, 44-45 and 55-56 under 35 U.S.C. § 102(b) as allegedly anticpiated by U.S. Patent No. 4,489,274 ("Berlincourt").

It is well established that in order for a piece of prior art to anticipate a claim, the prior art must disclose all of the claim elements. ("A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)).

Rejection of Independent Claim 1

Claim 73 (corresponding to original claim 1) requires that three axial gradiometers be provided. Contrary to the Examiner's assertion in rejecting now-cancelled claim 39, Berlincourt fails to disclose or suggest three axial gradiometers. Applicants note that in the December 28, 2007 rejection, while claim 39 was listed as anticipated, the Examiner did not point to any portion of Berlincourt which allegedly disclosed three axial gradiometers.

Looking more closely at the prior art, Berlincourt discloses in Figures 4 and 5 an apparatus comprising one axial gradiometer, see feature 52. Berlincourt discloses in Figure 8 an

apparatus comprising one axial gradiometer, see feature dH_y/dy. Berlincourt in Figure 9 discloses an apparatus comprising one axial gradiometer, see feature dH_y/dy in the device orientation shown on the left of Fig. 9, or feature dH_z/dz in the rotated orientation shown on the right of Fig. 9. Berlincourt nowhere discloses or suggests an apparatus comprising three axial gradiometers.

Further, claim 73 recites that each of the three gradiometers be angularly displaced about an axis which is not parallel to a respective axis of any other of the gradiometers. Berlincourt in Fig. 5 discloses an apparatus to be rotated about two orthogonal axes, see features 54 and 124 and col. 6 lines 52-53. Berlincourt in Figure 8 discloses two apparatuses to be rotated about two respective axes, being the *x* axis in Figure 8(a) and the *z* axis in Figure 8(b). Berlincourt in Fig. 9 discloses an apparatus to be rotated about one axis, the *x* axis, see col. 9 lines 48-49. Berlincourt nowhere discloses or suggests rotation of any apparatus about three non-parallel axes, much less the rotation of three axial gradiometers about three respective non-parallel axes.

Still further, claim 73 recites that the output signals of the gradiometers be used to determine both gradient tensor components and field components. In contrast, at col. 6 lines 18 to 27, Berlincourt states that complete determination of all three components of the magnetic field vector and all five independent elements of the gradient tensor requires a SQUID magnetometer 48, a diagonal gradiometer 52, and an off-diagonal gradiometer 50. Berlincourt teaches that magnetometers and off-diagonal gradiometers are essential to obtain the full field vector and the full gradient tensor. Berlincourt nowhere discloses or suggests that axial gradiometers alone may yield both gradient tensor components and field components.

For the preceding reasons it is respectfully submitted that Berlincourt does not anticipate claim 73.

Moreover, Berlincourt makes no suggestion as to the desirability of making the necessary modification to yield the invention of claim 73, and one of ordinary skill in the art would not have been motivated to make the proposed modification to yield that invention. It is noted that Berlincourt relates to low temperature superconducting (LTS) devices, and in fact dates from 1980 <u>which was before high temperature superconductivity (HTS) had even been discovered</u>. The 1/f low frequency noise threshold for LTS devices is around 1 Hz, as shown in Figure 11 of Berlincourt, and Berlincourt teaches that rotation should occur at a frequency that need merely be greater than around 1 Hz (see Col. 12 lines 47 – 51). By contrast, in HTS devices the 1/f noise corner is much higher, around 10 Hz. At column 7, line 60 to column 8, line 2, Berlincourt teaches that tracking of rapidly changing signals is best achieved by providing a duplicate apparatus and rotating the two apparatuses around orthogonal axes. Accordingly, it is submitted that one of skill in the art would not have been motivated by Berlincourt to produce the invention of claim 73. Rather, the person skilled in the art would be led away from that invention by Berlincourt's use of low temperature superconductivity, the use of magnetometers and planar gradiometers, and the suggestion that to track rapidly changing signals requires duplication of substantially the whole device. Accordingly, it is submitted that claim 73 is patentable over Berlincourt.

Applicants submit further that claim 79, also reciting three axial gradiometers, is patentable over Berlincourt for at least the same reasons that claim 73 is patentable. Therefore,

Applicants submit that all of claims 73-91 (claims 74-78 and 85-88 depending from claim 73, and claims 80-84 and 89-91 depending from claim 79) are patentable over Berlincourt.

The Examiner further rejected claims 1, 2, 20 and 21 under 35 U.S.C. § 102(b) in light of US 5,357,802 (Hofmeyer). However, Applicants submit that Hofmeyer makes no suggestion as to the desirability of making the necessary modification to yield the inventions of claims 73 and 79 (to which claims 1 and 20 respectively correspond), and one of ordinary skill in the art would not have been motivated to make the proposed modification to yield those inventions. Hofmeyer relates only to gravity gradiometry and does not disclose electromagnetic field detection. Nor can the techniques of Hofmeyer be translated to electromagnetic field detection. In particular it is not the case that substituting magnetic vector sensors in place of the accelerometers of Hofmeyer would yield an analogous electromagnetic field detection device.

The non-analogous nature of Hofmeyer is illustrated by the gravity gradiometer of Hofmeyer requiring 24 accelerometers to obtain the complete gravity gradient tensor (Figure 1, col. 3 lines 46 to 53). In contrast, the claimed invention allows the complete magnetic gradient tensor to be obtained by deployment of only three magnetic gradiometers each comprising just two vector field sensors.

The non-analogous nature of Hofmeyer is further illustrated by Hofmeyer's focus on removing rotational speed-related signals by providing eight accelerometers on a disc to be rotated, and positioning each group of four accelerometers at a 45° rotational offset. Hofmeyer thus teaches provision of a complete duplicate set of sensors to effect cancellation of harmonics (col. 2, lines 1 to 17, col. 2, lines 61-65). Such geometrical cancellation in the realm of gravitational field detection cannot simply be applied to electromagnetic field detection.

Consequently, Applicants submit that Hofmeyer is not a reference to which the skilled artisan would turn when faced with problems of magnetic field detection.

The non-analogous nature of Hofmeyer is further illustrated by the preferred embodiment of Hofmeyer adding vectors measured by opposed sensors, determining a difference between the sum of a first pair of sensors to the sum of a second pair of sensors at 90 degrees to the first pair, and demodulating the difference signal at twice the rotational frequency (see abstract, Fig. 5, col. 6, line 41 to col. 9, line 2). Demodulation requires mixing down-conversion with both I & Q reference signals (see reference numeral 84 in Fig. 5). This is in contrast to the preferred embodiment of the present application, involving extraction of spectral components of the sensor signals for example by Fourier Transform or Discrete Fourier Transform. This aspect is claimed specifically in claims 85, 88, 89, and 91.

The non-analogous nature of Hofmeyer is further illustrated by the fact that the detected gravity field intensity of the system of Hofmeyer depends on the radius at which each sensor is placed from the axis of rotation (see col. 8, lines 8-10, and note the presence of R in equations 1-8). This is not the case in the electromagnetic field detection of the present invention, further illustrating that the gravity field detection as taught by Hofmeyer cannot simply be applied to electromagnetic field detection. Accordingly, it is submitted that claims 73-91 likewise are patentable over Hofmeyer.

Conclusion

Pursuant to the foregoing discussion, Applicants submit that claims 73-91 are patentable, and are in condition for allowance. Accordingly, withdrawal of the rejections and allowance of the application are courteously solicited.

The Office is hereby authorized to charge any fees, or credit any overpayments, to Deposit Account No. **11-0600**.

Respectfully submitted,
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